University of Maine



# Maine Agricultural Experiment Station

## ORONO

BULLETIN 345 MAY, 1928

## THE CHAIN-DOTTED MEASURING WORM

### A Blueberry Pest

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BULLETIN 345

# THE CHAIN-DOTTED MEASURING WORM

## A Blueberry Pest[1]

By C. R. Phipps

## SUMMARY

The chain-dotted geometer is here recorded for the first time as a serious pest of the blueberry although its scientific history dates back to 1770.

During seasons of unusual abundance this insect may destroy thousands of dollars worth of blueberries under Maine conditions. Such outbreaks not only result in heavy losses during the current year but, by dwarfing and weakening the plants, greatly reduce the yield during the following season.

The larvae or loopers exhibit a liking for a wide range of food including some 47 different plants. Heretofore the recorded outbreaks of outstanding economic importance have been concerned for the most part with the blackberry, huckleberry, and cranberry.

The insects appear in mid-summer and feed until after harvesting. Their yellow and black coloring and habit of daytime feeding make them quite conspicuous.

Insect attacks are usually more or less localized at first thus affording the observant and alert grower an opportunity to check an outbreak with a minimum expenditure for labor and materials. The chain-dotted geometer may be effectively controlled by thoroughly spraying the plants with arsenate of lead at the rate of one and one half pounds in 50 gallons of water.

Since our observations clearly indicate that blueberry pests, in general, are more destructive to fields bearing their first crop after burning, such fields should be watched closely throughout the season.

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[1]Papers from the Maine Agricultural Experiment Station: Entomology No. 124.

For the convenience of the non-technical reader, questions relating to synonymy, and other matters primarily of scientific interest are discussed in separate sections at the back of this bulletin, see pp. 43-48.

**Experimental work conducted at this Station during the past season revealed two new parasites of this insect. One of these proved to be quite beneficial since it destroyed from 5 to 10 per cent of the loopers.**

## INTRODUCTION

While the chain-dotted measuring worm or geometer has been recognized by entomologists as a resident of many years standing in this state and has periodically been reported in considerable abundance, it has never before been recorded as a blueberry pest in Maine. In fact it was not until 1924, in Canada, that the insect was revealed as an enemy of the blueberry. A number of years ago it had been mentioned as feeding on the huckleberry (1)[2] in Connecticut. During the season of 1927 the larvae or loopers were present in great numbers in Maine and their feeding assumed economic importance in a number of blueberry fields, especially in Hancock County.

The adult insect is a moth, *Cingilia catenaria* (Drury), which belongs to the family *Geometridae*, a large family of moths, the larvae of which often resemble twigs, usually have but two pairs of abdominal legs, and progress by a looping movement, bringing the posterior end forward, then advancing the anterior end, whence the name measuring worms or loopers.

## DESTRUCTIVE HISTORY

This insect was named by an English worker in 1770, over a century and a half ago. It is interesting to note that the moths which he named were sent to him from New York. The species is a distinctive one both in habit and appearance. Unlike many moths the chain-dotted geometer flies by day and, since it is above average size, and possesses whitish wings it is rather conspicuous. It was not until 1841, about 70 years after it was named, that Harris (13) in his "Report on the Insects of Massachusetts Injurious to Vegetation" first described the looper as an injurious pest. Nearly 50 years later Packard (19) in his report on "Forest Insects" listed the moth as fairly common in New England and stated that the larvae feed upon conifers as well as upon black-

[2]Reference is made by number (italic) to "Literature cited", p. 47.

berry, wood-wax, wild indigo, and various sedges. In 1892 Webster referred to this looper as a pest of the blackberry (23) in Ohio and stated that, "On some occasions the moths appear in enormous numbers. An instance is recorded where their numbers were so great and the mass so dense in some places that it appeared like a snow storm, and alarmed the farmers who erroneously supposed them to be progenitors of the army worm." A few years later Lugger (16) stated that in Minnesota the moths periodically appear in alarming numbers and that some of them can always be found flying about during the middle of September. Lintner (14 and 15) in 1888 and 1891 reported unusually heavy flights of the moths in New York and Pennsylvania. In 1903 and 1904 similar flights were noted by Britton (1 and 2) in Connecticut.

In 1905 an outbreak of the larvae or caterpillars was recorded in Maine by Patch (20) with sweet fern listed as the preferred food plant. Similar outbreaks occurred in New Hampshire during the same season. Two years later Sanderson (21) published an account of a very heavy outbreak in New Hampshire. He observed that the larvae which normally feed on sweet fern stripped large areas and "spread to birch, wild cherry, apple, or whatever presented itself, including many common weeds". In 1907 Hardenberg and Malde (12) first referred to the activities of this insect as a cranberry pest in Wisconsin stating that it is found widely distributed over the state. During the same year Hardenberg (11) in his bulletin on "The Cranberry Insects of Wisconsin" listed the chain-dotted geometer as a cranberry pest, although he called it the yellow cranberry looper.

More recently Franklin (8) included this looper among the insect pests of the cranberry in Massachusetts. In 1920 (3) and 1924 (4) we find further records of the insect in Connecticut. Gorham (9) reported an outbreak of this looper in Nova Scotia in 1924 destroying the cranberry and a number of other plants including the blueberry.

The foregoing constitutes a brief review of the economic history of the insect up to the present time. In summing up it may be stated that the chain-dotted geometer is a native insect; that it has been recognized as such since 1770; that its depredations have been confined to the more northern regions; and that its chief economic importance has centered around the blueberry, blackberry, and cranberry.

## THE DIFFERENT STAGES[3]

The chain-dotted geometer in common with other moths passes through four stages in completing its life cycle. These stages are (1) the adult or moth stage, a period of dispersal and egg laying; (2) the egg stage in which winter is passed; (3) the larval, caterpillar, or looper stage during which the destructive feeding occurs; (4) the pupal or resting stage during which the insect remains quietly suspended in its cocoon.

The adult moth is readily recognized by its size and color. The wings are smoky white, thin and rather transparent. The outer edge of both fore and hind wings is marked by a faint black line which is interrupted by a number of distinct black spots. Half way between this line and the distinct discal spot is an irregular, scalloped line or chain of black dots, whence the name chain-dotted geometer. The males may be distinguished from the females by their plumose or feathery antennae and greater wing spread. The moths have a wing spread varying from one and one tenth to one and eight tenths inches. They are day fliers and when at rest their wings are spread out horizontally as in the case of other geometers. (Fig. 6, A & B).

The eggs are pale yellowish green in color at first. A little later they turn dark violet and become even darker before hatching. They are elliptical in shape and less than one twelfth of an inch in length.

The larvae or loopers have yellowish, cylindrical, slender bodies. On the sides of the body just above each spiracle or air opening are two conspicuous black spots. Two narrow, brown parallel lines are present just above the black spots on each side of the body. Two similar lines on the sides are interrupted by the black dots. The underside of the larva is greenish yellow broken on either side by four rows of longitudinal brown lines. Each larva has two pairs of abdominal legs in addition to the usual three pairs attached to the thorax. When full grown the loopers measure from one and one half to nearly two inches in length. (Fig. 6, C & D).

The pupa is white in color and is marked with conspicuous black blotches. Length about three fourths of an inch; greatest width about one sixth of an inch. (Fig. 6, E & F).

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[3]Technical descriptions may be found on p. 44.

Each larva or looper constructs a cocoon before changing to the pupal condition. This cocoon consists of a loose net work of coarse, yellow threads with such large meshes that the pupa within is readily discernible. (Fig. 6, G). After completing the cocoon the larva casts its last larval skin out through one of the meshes and quietly awaits its emergence date.

## Range of Food[4]

The chain-dotted measuring worm, when present in great numbers, will feed upon a fairly wide range of plants as indicated by our Maine observations and those made elsewhere. During the outbreak in 1927 the loopers were found working on twenty different kinds of plants.

As in the case of certain species of climbing cutworms it is probable that in the early stages the loopers feed upon a more restricted list of plants. During periods of great abundance and especially when nearly full grown, the caterpillars will, owing to food scarcity, attack nearly every green plant in the infested field or bog. Sanderson (21) made the following statement concerning an outbreak in New Hampshire: "The normal food plant of the caterpillars is the so-called sweet fern, *Myrica asplenifolia,* which often covers the rocky hillsides of New Hampshire.******During August these plants were stripped over considerable areas in many sections.*******they spread to birch, wild cherry, apple, or whatever presented itself, including many common weeds". The chain-dotted geometer has been reported as a cranberry pest in Wisconsin and Massachusetts (8), also in Nova Scotia (9). The two botanic families which include the greatest number of acceptable plants are, in the order of their importance, the Rosaceae, or Rose family with 10 species and the Ericaceae or Heath family with 5 species. The former includes the blackberry and the latter the blueberry, huckleberry, and cranberry which together comprise the principal economic host plants of this insect.

## Seasonal History

This measuring worm is single brooded with the adult or moth stage occurring in the fall. In the Eastern states emergence usual-

[4]A complete food plant list may be found on pp. 45-47.

ly begins about the middle of September and continues until the middle or last of October. The first moth seen in the field in 1927 was noted emerging from its chrysalis on September 13. On that date one moth emerged in the laboratory and, during the following two weeks, the majority of the moths made their appearance. Mating takes place within a few days after emergence and egg-laying begins a day or two later. The writer has observed the process of egg-laying in the fields and in the laboratory on a number of occasions during the past season. On September 23 a number of females were found ovipositing in blueberry fields near Brunswick. The moths flew lazily about depositing their eggs singly. The usual procedure was first to alight upon the upper surface of a sweet fern leaf. The abdominal segments were then bent down and under the leaf or twig and the ovipositor extended until an egg was attached to the lower surface. The eggs were laid singly, the female moths often flying to another bush after depositing one egg. In many cases the tiny green eggs subsequently failed to stick and dropped to the ground. Sanderson made a similar observation in New Hampshire. Our observations indicate that the moths select the sweet fern in preference to other plants for the purpose of egg deposition. However, it is likely that a number of other plants may be utilized for this purpose inasmuch as some of the moths were found ovipositing on a species of brome grass, *Bromus ciliatus* L.,[5] which occurs abundantly in certain of the blueberry fields.The writer captured a number of females and they continued egg-laying in captivity, in some cases for two weeks or longer. The moths confined in glass vials laid their eggs on pieces of cheese cloth, on the sides of the vials, and in some cases simply dropped them at random. The greatest number of eggs laid by any individual was 257 but this number probably did not represent the maximum as she had undoubtedly deposited some eggs before being captured. Lugger (16) in 1898 recorded the maximum number in his experimental work as 368. Gorham (9) reported an average of 140 per female.

A few days after oviposition the eggs change in color from light green to lilac and later to brown. Winter is passed in this stage, the majority of the eggs lying on the ground under a blanket of snow during the winter months. We have no record covering the usual time of hatching but as the mature larvae were not pres-

[5]Determined by Dr. F. H. Steinmetz, University of Maine, Orono, Maine.

ent until the latter part of August last season hatching probably did not take place until about the first of June. According to Dyar (7) the caterpillars pass through five larval instars or growth stages before attaining their growth. At the end of each instar the looper discards the old skin which it has outgrown and acquires a new and larger one.

Upon attaining maturity each worm spins a loose net about itself and then proceeds to cast off its last larval skin. From three to four weeks are spent quietly in this hammock or swing. Then the pupal skin breaks open in the region of the head and the moth crawls forth to remain quietly attached to the supporting twig or cocoon until its wings are dried out. A few pupae were noted in the fields on August 18 and the first moth was observed, as stated above, on September 13.

## Habits and Nature of Injury

We have already referred to the vast numbers of moths which occasionally appear in the fall in certain sections. Maine, New Hampshire, New York, Pennsylvania, Ohio, and Connecticut are among those states in which flights of snow-like intensity have been noted. Naturally the egg-laying possibilities of millions of moths are enormous and it is therefore logical to expect local outbreaks of the loopers during seasons following such flights. While egg-laying is probably restricted, for the most part, to a period of two or three weeks beginning about the middle of September in Maine, some of the moths live until winter. They have been reported as late as December 1 in New Hampshire.

Outbreaks of the larvae sometimes occur on high land but nearly all of our records indicate that, in the beginning at least, the infestations were confined to bog or low land. The outbreaks observed by the writer during the past season had their inception in low land. Later on, due to scarcity of food, the loopers migrated in army worm fashion to higher land. In one instance they gradually ate their way out of a swamp, then across a field containing a considerable stand of sweet fern and other bushes, and finally migrated into a large blueberry field. The worms were so numerous that in many cases there were three or four loopers to a single plant. At that time the blueberry crop was being harvested and the worms not only defoliated the bushes but also ate

the berries, ripe and otherwise. Areas over which the loopers had fed were brown and, from a distance, appeared as though they had been swept by fire. The majority of the caterpillars were then in their last instar and capable of consuming a considerable quantity of foliage in a short period of time. When disturbed these inch-worms or span-worms will, in common with other loopers, hold their bodies stretched out rigidly at an angle with the stem thus simulating a branch or twig.

When through feeding and ready to pupate each looper begins to construct its cocoon. It proceeds to weave and spin a loose netting or cocoon which it attaches to the leaves or stem of the plant on which or near which it had previously been feeding. Many cocoons were noted on the trunks and branches of balsam and other conifers in the fields as well as on the blueberry and other low-growing bushes.

Naturally enough the periodically severe outbreaks are the ones commonly noticed. On the other hand the writer has noted this insect in limited numbers in blueberry fields during both the 1925 and 1926 seasons. Growers have stated that they always expect to find a few loopers working in their fields but that they are usually of no importance. The writer believes that this insect has been on the increase for several seasons and, because of the rather high percentage of emergence, it is quite possible that the peak has not been reached yet. Following such a high point we often experience a very sudden and nearly complete disappearance due to mortality caused by parasites and disease. Sanderson (21) in 1906 reported that, "numerous parasitic and predaceous insects were found preying upon them, but probably 80 to 90 per cent were dying from disease." Quite a number of the loopers under observation last summer were subject to parasitism, but disease did not appear to play a very important role. At any rate the writer experienced no difficulty in rearing adult moths. From the number of moths observed flying about in the fields this fall it would be logical to anticipate localized outbreaks another season.

## NATURAL ENEMIES[6]

The chain-dotted geometer, in common with many other insects belonging to the moth and butterfly group, has a number of

[6]A list of the scientific names may be found on p. 47.

natural enemies. The writer has been unable to find a single account of birds attacking these loopers but further observations might disclose some interesting facts relative to this phase of natural control. Sanderson reported numerous parasitic and predaceous insects attacking the loopers although he did not record the species concerned. He also stated that disease was taking such a heavy toll that he had difficulty in rearing moths for breeding purposes. During the past season the writer noted that under Maine conditions a very small per cent of the worms died from the effects of disease.

Our 1927 breeding experiments resulted in obtaining data on three different species of parasites. Of these parasites one was a dipteron or fly while the others were hymenoptera or wasps. The fly had previously been reared from the same host by Gorham in Nova Scotia. It is interesting to note that the two wasps had not been recorded before as parasites of this insect. One of the latter was by far the most abundant natural enemy noted in 1927. Larvae parasitized by this insect usually remain clinging to the bushes on which they die. The parasites then emerge from the dead or dying caterpillars and proceed to spin a thread three or four inches in length. One end of the thread is attached to a twig or leaf and the parasite hangs from the other end. (Fig. 7, 1). In a short time the insect which is in the larval stage transforms to the pupal stage and remains suspended in close proximity to the body of its victim. Therefore the parasite cocoons could be readily seen and collected. The first of these cocoons was found in North Sedgwick on August 18. The majority of the adult wasps emerged from these cocoons during the week of August 29 thus indicating that the pupal period lasts from a week to ten days. From five to ten per cent of the loopers were parasitized by this species alone. The other wasp was not present in sufficient numbers to have any appreciable influence on the control of the loopers. In addition to the three parasites mentioned above only two others appear to be listed in connection with the literature concerning this geometer. Both of these are flies which were reared by Gorham in Nova Scotia.

## Control Measures

Little or nothing appears to have been published on the subject of the economic control of this insect. In cranberry bogs

outbreaks of this and similar loopers are often controlled by flooding the bog for a short time, thus drowning the pests. This procedure would, of course, be out of the question in blueberry fields.

Loopers or geometers, unlike cutworms, are readily poisoned by arsenicals used as a spray at the strength normally recommended for the control of orchard insects. The writer was afforded an excellent opportunity to test the efficiency of arsenate of lead during the past season in this connection. In one locality it so happened that when the outbreak was first noted the loopers had just finished stripping nearly every green plant in a low lying pasture adjacent to a large blueberry field. When this outbreak was discovered the worms were crossing over into the berry field in vast numbers. At no point had they penetrated more than a few feet into the field although they were entering it along one entire side, a distance of several hundred yards. A small compressed air sprayer was employed to apply the mixture to a narrow strip along the edge of the field and just in front of the line of march. Arsenate of lead was used at the rate of one and one half pounds (dry) in 50 gallons of water. The following morning an examination of the field was made. While some of the loopers were actually dead, the great majority appeared decidedly "sick" as evidenced by a failure to eat or to move about actively. None of the worms had progressed beyond the sprayed strip and as a matter of fact very few ever did. Twenty-four hours later (forty eight hours after spraying) practically all of the loopers in that area were dead or inactive. Therefore the control was at once effective and inexpensive. Of course conditions are not always ideal, nor, on the other hand, are all growers as observant as this one proved to be. In some instances an attack may be more or less scattered over a blueberry field thus necessitating the expenditure of more time and spray material. Before making counts to determine the effectiveness of the treatment the grower should wait at least 48 hours after the poison has been applied.

## RECOMMENDATIONS

Constant vigilance is undoubtedly the most important factor in the control of this as well as other insects. Prompt action should immediately follow the first semblance of an outbreak. Arsenate of lead thoroughly applied at the rate of one and one half pounds in 50 gallons of water will give effective control.

With the increasing interest and acreage devoted to the production of blueberries in various parts of the state it becomes correspondingly important that the growers should know the different insects and diseases which prey upon their crop. We know less about the subject of blueberry insects than we do about most fruit insects for, until recent years, people picked blueberries to eat or to can at home and the fruit was considered a wild one and, therefore, common property. At the present time there are in Maine some thirty canning factories which turn out an annual pack representing in the neighborhood of 90 per cent of the entire world output and valued at around two and one quarter millions of dollars.

Because of the increasing value of the crop it behooves the blueberry grower to watch his bearing fields closely throughout the season. This practice should begin in the spring when the buds are swelling—the time when climbing cutworms become active—and continue until the crop is harvested. The writer's observations clearly indicate that insect pests, in general, are more destructive to fields bearing their initial crop after burning than to those bearing a second or third crop. In fact the records show that climbing cutworms attack new pieces only. Such fields should, therefore, receive special attention.

Insect attacks are usually more or less localized at first thus affording the observant and alert grower an opportunity to check an outbreak with a minimum expenditure for labor and materials. This is especially true in the case of loopers and cutworms.

As time goes on and the blueberry industry becomes more intensive the damage caused by insect pests will doubtless become more noticeable. It may safely be predicted that, as in the case of the old established apple and small fruit industries, cooperation between the growers, canners, and scientific investigators will bring about the successful solution of these problems.

## Technical Data

Since this insect has been known to entomologists during the past century and a half under a number of different scientific names it seems important to list some of them.

*Geometra catenaria* Drury
1770. Illustrations of Natural History of Exot. Ent., I:17

*Phalaena catenaria* Fab.
1794. Fab., Ent. Syst., III (part II), p. 140.
*Orthostixis catenaria* Hubn.
1806. Samml. Exot. Schm., bd. ii.
*Bupalus catenarius* Westw.
*Zerene catenaria* Guen.
1862. Walker, List Lepid. Het. Brit. Mus. XXIV, p. 1136.
*Caterva catenaria* (Drury)
1876. Grote, Canad. Ent. 7: 205-206.
*Cingilia catenaria* (Drury)
1894. Dyar, Canad. Ent. 26:69.

## DESCRIPTIONS

It may be of interest to quote the original description by Drury as follows:

"*Upper-side.*—The *Head,* is orange coloured.—The *Eyes* black.—The *Antennae,* are broad, and pectinated.—The *Body,* white; whereon are three spots of orange colour; one at each shoulder, the other at the bottom, near the abdomen, over which are two small black specks.—The *Abdomen,* is white, and on each ring, is a small black speck.—All the *Wings* are of a fair white; and, on each *Superior* one, are two denticulated lines, running cross the wing, from the anterior to the posterior edge, in a circular manner: the one near the shoulder, the other near the external edge; which last forms, on every tendon or membrane, small specks like arrow heads. Between the two lines, is a black spot, near the anterior edge.—The *Inferior Wings,* have a similar line running cross them, from the anterior to the abdominal edges, in a circular manner; and, meeting a little above the extremity of the abdomen, with a black spot in each near the middle.—On the *Fringe* of both superior and inferior wings, is a series of black spots, one on each membrane or tendon.

"*Under-side.*—Is similar to the upper; only the black spots are more conspicuous.

I received it from New York.

I have not seen it described in any author."

The egg has been described by Dyar as follows:

"Eliptical, gently flattened on two sides, one end distinctly and sharply truncate, making the egg not much longer than wide; the other end slightly depressed, rounded; truncate end slightly con-

cave. Smooth, uniformly and rather finely reticulate, the reticulations irregularly hexagonal, slightly raised, subgranular, the areas flat. Truncate end only faintly reticulate, the margin a smooth rim, a dark spot at the micropyle. Pale yellowish green, soon turning sordid violet and darkening still further before hatching. Size 1.8 x .7 x .5 mm."

The pupa has been described by Mosher (17) as follows: "Color white with conspicuous black blotches, the largest of these on the dorsum of the first five abdominal segments, the wing veins and some of the sutures lined with black; entire surface of body with shallow transverse impressed lines; antennae elevated, highest along the middle line, transversely lined with black; mesothoracic spiracles split-like; abdominal spiracles without any outer margin, the openings elliptical; cremaster with two large spines and six smaller ones. Length 15 to 18 mm., greatest width 3.5 to 4 mm." (Fig. 6, E and F).

## Host Plant List

The writer has previously discussed under "range of food" something of the food preference exhibited by this insect. The following list includes 47 distinct plants representing 17 botanic families. Those marked with an asterisk are plants upon which *Cingilia catenaria* has been observed to feed under Maine conditions.

### Fern Family

*Fern, *Dicksonia punctilobula* Gray

### Pine Family

*Balsam, *Abies balsamea* Mill.
Red spruce, *Picea rubra* Dietr.
Tamarack, *Larix laricina* Koch.
White pine, *Pinus strobus* L.

### Sedge Family

*Sedge, *Carex pennsylvanica* Lam.

### Willow Family

*Poplar, *Populus* sp.
*Willow, *Salix candida* Flugge

### Sweet Gale Family

*Bayberry, *Myrica caroliniensis* Mill.
*Sweet fern, *Myrica asplenifolia* L.

BIRCH FAMILY

*Alder, *Alnus* sp.
*Gray birch, *Betula populifolia* Marsh.
Hazel, *Corylus* sp.
*White birch, *Betula alba* var. *papyrifera* Marsh.

BEECH FAMILY

Beech, *Fagus* sp.
Chestnut, *Castanea* sp.
Oak, *Quercus* sp.

NETTLE FAMILY

Elm, *Ulmus* sp.

PLANE TREE FAMILY

Sycamore, *Platanus occidentalis* L.

ROSE FAMILY

Apple, *Pyrus Malus* L.
Blackberry, *Rubus* sp.
*Hardhack, *Spiraea tomentosa* L.
Hawthorn, *Crataegus* sp.
Meadow-sweet, *Spiraea latifolia* Borkh.
Pear, *Pyrus communis* L.
Plum, *Prunus* sp.
*Raspberry, *Rubus strigosus* Michx.
*Rose, *Rosa* sp.
Wild cherry, *Prunus* sp.

PULSE FAMILY

Wild indigo, *Baptisia tinctoria* L.
Wood-wax, *Genista tinctoria* L.

CASHEW FAMILY

Sumac, *Rhus* sp.

MAPLE FAMILY

Sugar maple, *Acer saccharum* Marsh.
White maple, *Acer saccaharinum* L.

SOAPBERRY FAMILY

Horse chestnut, *Aesculus* sp.

HEATH FAMILY

Cranberry, *Vaccinium* sp.
*Huckleberry, *Gaylussacia baccata* C. Koch
*Low sweet blueberry, *Vaccinium pennsylvanicum* Lam.
Rhododendron, *Rhododendron* sp.
*Sour-top blueberry, *Vaccinium canadense* Kalm.

Olive Family

Ash, *Fraxinus* sp.

Composite Family

*Everlasting, *Anaphalis margaritacea* var. *occidentalis*
Golden-rod, *Solidago* sp.
*Rattlesnake-root, *Prenanthes alba* L.
*Wild lettuce, *Lactuca canadensis* L.

## Parasite Records

As previously indicated under the heading "Natural Enemies" the writer has found only three parasites mentioned in the literature. These were all Tachinids which were reared from the larvae by Gorham in Nova Scotia. In our 1927 breeding experiments one dipteron and two hymenoptera were recorded as parasites of *Cingilia catenaria*. The dipteron, *Madremyia saundersii* Willst.[7], proved to be identical with one of the Tachinids previously recorded by Gorham. On the other hand the hymenopterous parasites have not been previously recorded. The species which was by far the most abundant has been determined as *Meteorus datanae* Mues.[8] (Fig. 7, H & I). Two secondary parasites, *Hemiteles tenellus* (Say)[9] and ? *Mesochorus lutcipes* Cress[9], have been reared from the cocoons of *Meteorus datanae* Mues.

The second hymenopterous parasite, *Itoplectis conquisitor* (Say)[9], was not reared in sufficient numbers during the 1927 season to indicate that it played an important part in the natural control of the loopers.

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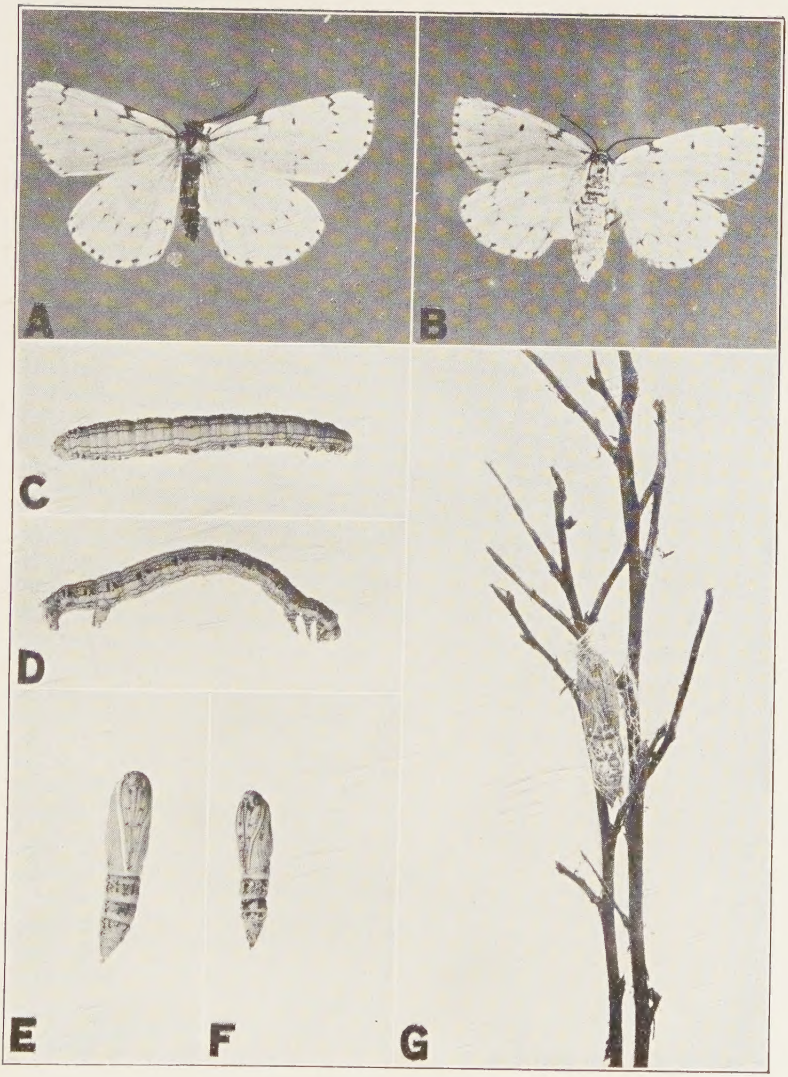


FIG. 6. Chain-dotted geometer and work: A and B, male and female moths; C and D, dorsal and side views of full grown caterpillar; E and F, female and male pupae; G, defoliated blueberry plant showing pupa in its cocoon.


FIG. 7. H, cocoons of *Meteorus datanae* Mues. on blueberry plant; I, *Meteorus datanae* Mues. and cocoon.